Claims

[c1] 1. A controlled-flow microwave instrument for chemical synthesis that includes heterogeneous or highly viscous materials, said instrument comprising
a fluid reservoir for supplying or receiving fluids;
a fluid pump in fluid communication with said reservoir for pumping fluids to or from said reservoir;
a microwave transparent reaction vessel in fluid communication with said pump for supplying or receiving fluids to or from said pump and said reservoir;
a pressure sensor in fluid communication with said supply and said vessel for measuring the pressure of fluids in said instrument at said sensor; and
a processor in signal communication with said pressure sensor and said pump for controlling said pump and the flow of fluids in said instrument based at least in part on the pressure measured at said sensor.

[c2] 2 An instrument according to Claim 40 comprising tubing for providing the respective fluid communication between said reservoir, said pump, and said reaction vessel.

[c3] 3. An instrument according to Claim 2 wherein said

wherein said sensor comprises:
a housing in communication with portions of said tubing;
a fluid inlet and a fluid outlet in said housing that define a flow path therebetween;
a pressure transducer positioned adjacent said flow path so that fluid pressure in said tubing is exerted against said transducer.

[c4] 4. An instrument according to Claim 1 wherein said pump comprises a reversible two-way pump.

[c5] 5. An instrument according to Claim 1 and further comprising:
a microwave cavity surrounding said vessel; and
a microwave source for propagating microwaves into said cavity and into portions of said vessel.

[c6] 6. An instrument according to Claim 5 wherein said cavity comprises a single mode cavity at the frequencies produced by said source.

[c7] 7. A microwave instrument for chemical synthesis that includes heterogeneous or highly viscous materials, said instrument comprising:
a microwave cavity;
a microwave transparent vessel inside said cavity for

holding reactants for exposure to microwave radiation;
a magnetic stirrer bar inside said vessel for agitating reactants in said vessel during exposure to microwave radiation;
a first rotating magnet positioned external to and adjacent said cavity to minimize any interaction between the magnetic field of said magnet and microwave propagation in said cavity; and
a second rotating magnet inside said cavity for being driven by said first rotating magnet and for driving the rotation of said stirrer bar in said reaction vessel.

[c8] 8. An instrument according to claim 7 and further comprising:
a microwave source; and
a waveguide in communication with said source and said cavity.

[c9] 9. An instrument according to claim 7 wherein said second rotating magnet is positioned in portions of said cavity that minimize any interference between the magnetic field of said second magnet and the microwaves in said cavity.

[c10] 10. An instrument according to claim 7 wherein said second rotating magnet is carried in a housing that is transparent to both microwave radiation and to magnetic

fields.

[c11] 11. An instrument according to claim 7 wherein said cavity includes an axle sleeve and said housing further comprises an axle for rotating in said sleeve when said second magnet is driven by the rotation of said first magnet.

[c12] 12. An instrument according to claim 7 wherein said second rotating magnet comprises:
a bar formed of a material transparent to both microwave radiation and to magnetic fields, with the respective ends of said bar defining the circumference of rotation of said bar in said cavity;
an outer pair of small magnets in said bar and respectively adjacent each end of said bar for coupling with and being driven by said first rotating magnet; and
an inner pair of small magnets adjacent the center of said bar for coupling with and driving said stirrer bar.

[c13] 13. An instrument according to claim 7 comprising a motor for driving the rotation of said first magnet.

[c14] 14. A method of conducting flow through microwave assisted chemistry comprising:
directing a flow of fluid between a reservoir and a reaction vessel;

exposing a portion of the flowing fluid to microwave radiation to thereby initiate or accelerate chemical reactions in the fluid;
measuring the pressure of the flowing fluid between the reservoir and the reaction vessel; and
conditionally reversing the flow of fluid based upon the measured fluid pressure.

[c15] 15. A method according to Claim 14 comprising directing the flow of fluid from the reservoir to the reaction vessel and reversing the flow of fluid when the pressure increases beyond an upper set point pressure.

[c16] 16. A method according to Claim 14 comprising directing the flow of fluid from the reservoir to the reaction vessel and reversing the flow of fluid when the pressure decreases below a desired set point pressure.

[c17] 17. A method according to Claim 14 comprising directing the flow of fluid from the reaction vessel to the reservoir and reversing the flow of fluid when the pressure increases beyond an upper set point pressure.

[c18] 18. A method according to Claim 14 comprising directing the flow of fluid from the reaction vessel to the reservoir and reversing the flow of fluid when the pressure decreases below a desired set point pressure.

[c19] 19. A method according to Claim 14 wherein the step of conditionally reversing the flow of fluid comprises signaling a processor based upon the measured pressure and reversing a pump based upon a signal from the processor.

[c20] 20. A method according to Claim 14 wherein the step of conditionally reversing the flow of fluid comprises adding additional fluid as the flow is reversed.